undeserved slur on an honourable and useful calling.

It is quite rational that many pharmacists should exhibit reluctance to part with a title which they have legally held since the Act of 1851, and one hallowed by the fact that some of the early chemists—for example, Scheele—were practising pharmacists. In the course of years, however, and following the necessary classification of innumerable chemical observations in a distinct branch of scientific knowledge, the extension of chemistry has passed almost entirely from pharmacists, who are thus designated by a misnomer. It is the purpose of the Pharmacy Acts Amendment Bill to rectify this irregularity as from the first day of January, 1925.

In view of the laudable object of the Bill and the support which the principle at least might be expected to receive from chemists, it is difficult to understand the action of the promoters in holding themselves aloof from the Institute of Chemistry, and not even consulting the council of that body. Consequent on this omission, the official attitude of the Institute has now been set forth in a letter from the registrar to the promoters stating that the council would welcome any legislation tending to remove the present confusion, which it deplores; but it dissociates itself from the suggestion that it should be represented on the central council, which, as proposed in the Bill, would be concerned with the pharmaceutical register. This attitude will be approved alike by pharmacists and by chemists, for the latter have not the slightest claim to participate in the registration of pharmacists; chemists have never suggested, or even contemplated, an action which pharmacists justifiably would resent as an interference with their own functions.

Echinoderm Larvæ and their Bearing on Classification.

Studies of the Development and Larval Forms of Echinoderms. By Dr. Th. Mortensen. Pp. iv + 261 + 33 plates. (Copenhagen: G. E. C. Gad, May, 1921.) *2l. 2s.*

THE development of Echinoderms from the egg presents one of the most striking of life processes known to us. The changes through which the individual passes are even more remarkable than those accompanying the more familiar metamorphosis of a caterpillar into a butterfly. The egg develops directly into a free-swimming larva of bilateral structure, adapted in most cases for pelagic life; within this larva there is gradually formed a body with radial structure and special organs, which, being set free from the larva, grows into the adult sea-urchin, starfish, crinoid, or holothurian—an adult rarely free-floating and generally abiding in one place. It is almost as though there were an alternation of generations, as though the larva bore the young echinoderm as a mother bears a child; and this idea, though not really justified, is forcibly recalled by Dr. Mortensen's account of an ophiurid larva, which, after dropping the young brittle-star, proceeds to reconstitute its own body, and continues life as an independent individual. Dr. Mortensen even suggests, rather audaciously, that it may repeat the metamorphosis.

It is with those larvæ that are adapted to a pelagic life that Dr. Mortensen is mainly concerned. The adaptation consists largely in the development of long rod-like processes, generally known as arms, although they have nothing to do with any structures so called in adult echinoderms. These processes serve as balancers and aid the flotation of the tiny creature. In only a few forms, however, do the skeletal rods support any paddle-shaped expansion of the soft tissues, and in only one, here first made known by Dr. Mortensen, can they be moved like oars by means of special muscles.

The absolute distinction between the larva and the adult, combined with the difference of habitat and the difficulty of raising all the stages in an aquarium, has long hindered the attempt to assign the various larvæ to their respective species. They have, therefore, for practical convenience, been classified and named on an independent system. In the present work Dr. Mortensen's chief aim has been to decide how far this classification agrees with that of the adults, or, to put the matter in another way, how far the differences and resemblances of the larvæ throw light on the affinities of the adult genera and species. Previously the pelagic larvæ of about seventy various echinoderms had been identified, and Dr. Mortensen here describes the development of fifty-five forms previously unknown. The data, therefore, though relatively very few, are enough to warrant a discussion of the problem.

In so many instances do the larvæ of closely related species resemble one another, so often do the larvæ of allied genera agree in important characters, so distinct are the larval forms of the several orders no less than of the classes, that Dr. Mortensen is justified in his conclusion that similarity of larval structure implies the relationship of the respective adults. The converse proposi-

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tion, that forms with essentially different larvæ are not nearly related even when there is some resemblance between the adults, may lead to dispute when applied to particular cases. But the conclusion can be tested by other characters. For instance, a Mediterranean sea-urchin, *Sphaerechinus granularis,* approaches Strongylocentrotus in certain features which have led Dr. H. L. Clark to refer it to that genus. Its larva, however, is found to agree with those of the Toxopneustidæ, not with those of Strongylocentrotus. A fairly good test is afforded by the minute structures of the pedicellariæ, and these confirm the conclusion drawn from the larvæ. Although we have as yet only random samples of larvæ from the thousands of living Echinoderm species, still observation, so far as it has gone, does indicate that here is new and valuable evidence of affinity.

In directing attention to this evidence, as when he demonstrated the importance of the microscopic characters of spines and pedicellariæ, Dr. Mortensen has provided the systematist with a new method. It is unfortunate that neither of these tests can (save in some exceptional specimens) be applied to fossils. They cannot oppose the palæontological argument, but they cannot assist it; we can only say that, for genealogical trees based on the evidence of dead ancestors to be correct, the arrangement of their ultimate living twigs must accord with the evidence of their larvæ and of their anatomy generally. In so far as the methods are sound, there can be no conflict between them. The unsound method is that which relies on only one or two characters and in addition too often ignores their historical development. The greater weight should always be attached to the older character. When palæontology cannot tell us directly which this is, we may assume that characters less likely to have been modified by changes in the environment are the older. That principle is, one supposes, consciously or subconsciously the basis of the ill-expressed statement that "anatomical characters" are more important than external characters. The microscopic structure of a minute spine is, whether "anatomical" or not, such a persistent character. Similarly, pelagic larvæ, living in an environment naturally subject to little change, must themselves remain long unchanged, and should therefore yield evidence of affinity more readily than do the later stages in their varied and variable surroundings.

It would be wearisome to repeat here the numerous particular conclusions which Dr. Mortensen bases on the resemblance of the larvæ. The Echinoidea yield the most results: one can recognise a distinct larval type for each of the orders Spatangoidea, Clypeastroidea, and, probably, Diademoidea, and for most of the main families in the regular Echinoids. The classification of the Ophiuroidea is, admittedly, so unsatisfactory that it has not been possible to correlate the accepted families with definite larval types, but for the Asteroidea this has been done to some extent. The larvæ of the Holothurians are not well known, and the Crinoids have not yet furnished a single pelagic larva.

Fortunately the study of the larvæ opens up more general questions, and many will wish to know whether Dr. Mortensen has anything to say on the interrelations of the classes or on the origin of the Echinoderms as a whole. He points out that the Brachiolaria larva of starfishes with its sucking disc, being found only among the more specialised forms, must itself be a late development, so that the sucker cannot be homologous with the stalk of the Crinoids. None the less Dr. Mortensen expresses his "perfect agreement" with the theory which derives all Echinoderms from a simple, bilaterally symmetrical creature—the Dipleurula—now represented by the earliest larval stage in each class, and which explains the five-rayed symmetry and the torsion of the internal organs as due to the fixation of the Dipleurula and its change into a sessile animal with upwardly directed mouth and vent. Seeing that this theory was published in 1900, it may be held to have attained its majority. The later theories of Simroth, A. H. Clark, and J. E. V. Boas are treated by Dr. Mortensen with something as near to contempt as this courteous writer ever permits himself. But as to the origin of the Dipleurula, Dr. Mortensen will express no positive opinion. He sees no connection with the Cœlentera. Certainly the transition was not direct, as Boas suggests; but a possible series of intermediate stages was sketched by the writer of the article "Echinoderma" in the "Encyclopædia Britannica," Editions X. and XI. (1902, 1911), an article always overlooked by writers outside Great Britain.

Other matters of general interest, such as geographical distribution or the influence of temperature, must be left for those who are wise enough to look for themselves at this clearly written, admirably illustrated, and well produced account of a long series of difficult observations. In these hard times we are more than usually indebted to the Carlsberg Fund, which has rendered possible the preparation and the publication of Dr. Mortensen's richly suggestive studies.

F. A. BATHER.

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